Name: ______________________ Date: ______________

Polynomial Operations SOLUTION (version 237)

1. Let polynomials $p(x)$ and $q(x)$ be defined below.

$$p(x) = -10x^5 - 5x^3 + 2x^2 - 3x + 6$$

$$q(x) = 6x^5 - 5x^4 - 3x^2 - 7x - 8$$

Express the sum of $p(x) + q(x)$ in standard form.

Get "unsimplified" forms. Then find $p(x) + q(x)$ with addition/subtraction.

$$\begin{aligned}
p(x) &= (-10)x^5 + (0)x^4 + (-5)x^3 + (2)x^2 + (-3)x^1 + (6)x^0 \\
q(x) &= (6)x^5 + (-5)x^4 + (0)x^3 + (-3)x^2 + (-7)x^1 + (-8)x^0 \\
p(x) + q(x) &= (-4)x^5 + (-5)x^4 + (-5)x^3 + (-1)x^2 + (-10)x^1 + (-2)x^0 \\
p(x) + q(x) &= -4x^5 - 5x^4 - 5x^3 - x^2 - 10x - 2
\end{aligned}$$

2. Let polynomials $a(x)$ and $b(x)$ be defined below.

$$a(x) = 5x^2 + 3x + 6$$

$$b(x) = -2x - 5$$

Express the product $a(x) \cdot b(x)$ in standard form.

You can use a table for multiplication.

*	$5x^2$	$3x$	6
$-2x$	$-10x^3$	$-6x^2$	$-12x$
-5	$-25x^2$	$-15x$	-30

$$a(x) \cdot b(x) = -10x^3 - 6x^2 - 25x^2 - 12x - 15x - 30$$

Combine like terms.

$$a(x) \cdot b(x) = -10x^3 - 31x^2 - 27x - 30$$

3. Express $(x + 1)^4$ in standard (expanded) form.

Remember the binomial theorem. It tells us to use Pascal's triangle.

$$x^4 + 4x^3 + 6x^2 + 4x + 1$$

Polynomial Operations SOLUTION (version 237)

4. Let polynomials $f(x)$ and $g(x)$ be defined below.

$$\begin{aligned} f(x) &= 2x^3 + 11x^2 - 16x + 29 \\ g(x) &= x + 7 \end{aligned}$$

The quotient of $\frac{f(x)}{g(x)}$ can be expressed as a polynomial, $h(x)$, and a remainder, R (a real number).

$$\frac{f(x)}{g(x)} = h(x) + \frac{R}{x+7}$$

By using synthetic division or long division, express $h(x)$ in standard form, and find the remainder R.

I prefer using synthetic division.

	2	11	-16	29
-7		-14	21	-35
	2	-3	5	-6

So,

$$\frac{f(x)}{g(x)} = 2x^2 - 3x + 5 + \frac{-6}{x+7}$$

In other words, $h(x) = 2x^2 - 3x + 5$ and the remainder is $R = -6$.

5. Let polynomial $f(x)$ still be defined as $f(x) = 2x^3 + 11x^2 - 16x + 29$. Evaluate $f(-7)$.

You could do this the hard way.

$$\begin{aligned} f(-7) &= (2) \cdot (-7)^3 \ + \ (11) \cdot (-7)^2 \ + \ (-16) \cdot (-7) \ + \ (29) \\ &= (2) \cdot (-343) \ + \ (11) \cdot (49) \ + \ (-16) \cdot (-7) \ + \ (29) \\ &= (-686) \ + \ (539) \ + \ (112) \ + \ (29) \\ &= -6 \end{aligned}$$

Or, if you reference the polynomial remainder theorem, you can state that you know $f(-7)$ equals the remainder when $f(x)$ is divided by $x + 7$. Thus, $f(-7) = -6$.